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First report of rugose spiraling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) on wild date palm, *Phoenix sylvestris* (L.) Roxb. (Arecaceae), along with natural parasitization in West Bengal, India

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Abstract

The current study from West Bengal reports for the first time that the wild date palm, *Phoenix sylvestris* (L.) Roxb. (Arecaceae), serves as a host plant for the globally invasive rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae). This forms the first documentation of natural parasitization of the whitefly by *Encarsia guadeloupae* Viggiani (Hymenoptera: Aphelinidae) in West Bengal.

Keywords: *Aleurodicus rugioperculatus, Encarsia guadeloupae*, First Record, *Phoenix sylvestris,* West Bengal

Introduction

Aleurodicus rugioperculatus Martin, 2004 (Aleyrodidae: Hemiptera) the global invasive whitefly (Aleyrodidae: Hemiptera), also known as rugose spiralling whitefly, is a polyphagous pest (Martin *et al.*, 2004). It is a Central American native that was accidentally introduced into India through the trade of ornamental plants (Shanas *et al.,* 2016). Sundararaj and Selvaraj (2017) reported a severe infestation of coconut palms for the first time in Tamil Nadu, India. Subsequently, it was reported from Andhra Pradesh, Assam, Karnataka and Kerala, infesting monocots and dicots (Rao *et al.,* 2018). Later, Selvaraj *et al.,* (2019) reported the species from West Bengal.

Taxonomic identification of whiteflies is mainly based on the 4th larval instar (puparium), which is distinct for each species (Mondal *et al.,* 2020). In the puparium of *A. rugioperculatus*, submarginal wide-rimmed pores form mesally-directed lobes, the pore band is immediately narrowing, the posterior lingula apex is almost absent, and the lingula almost reaching the puparial margin (personal comm. with, A.K. Dubey). Adults' habitus is large and have irregular brown markings on white forewings, they are largely inactive. Females lay yellowish eggs mostly beneath the surface of the leaves in a spiralling or concentric pattern, which they cover with white wax. Nymphs are oval-shaped and have white waxy material all over their body (Martin, 2004). Natural enemies such as parasitoids, *Encarsia dispersa* Polaszek, *E. guadeloupae* Viggiani, *E. noyesi* (Hayat) (Aphelinidae), *Aleuroctonus* spp. (Eulophidae); predators viz., *Azya orbigera orbigera* Mulsant, *Chilocorus cacti* (Linnaeus), *Cryptolaemus montrouzieri* Mulsant, *Cybocephalus* sp., *Delphastus pallidus* LeConte, *Harmonia axyridis* Pallas, *Hyperaspis bigeminata* (Randall), *Nephaspis oculate* (Blatchley) (Coleoptera) and chrysopid *Ceraeochrysa* spp. (Chrysopidae) are associated with *A. rugioperculatus* (Ramani *et al.,* 2002; Taravati *et al.,* 2013; Francis *et al.,* 2016). Natural biocontrol agents including *E. dispersa*, *E. guadeloupae*, *E. noyesi* and *Aleuroctonus* spp. are recommended for controlling this pest (Ramani *et al.,* 2002; Taravati *et al.,* 2013).

The wild date palm *Phoenix sylvestris* (L.) Roxb. (Arecaceae), grows over a wide belt, from the desert areas of northern Africa, Middle East, also extending to southern Asia, especially Bangladesh. They are also reported in the northeastern plains of India. The host tree is known to support the livelihood in villages (Zaid, 1999). Locally known as 'khejur' in Bengal, 'nolen gur' or the 'liquid date jaggery' prepared from the sap of this wild date palm is a great winter delicacy in West Bengal (Mathew *et al.,* 2016). However, an infestation of *P. sylvestris* by *A.*

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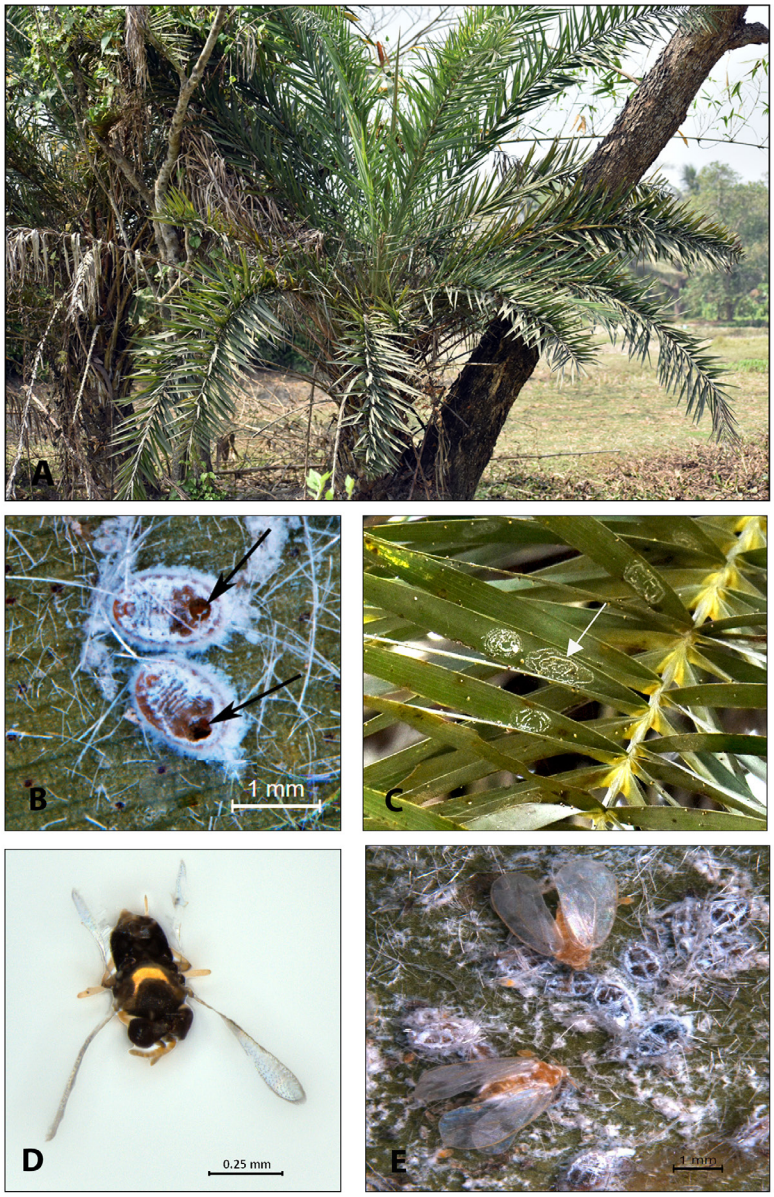
Table 1. Survey details

Area surveyed	Date of Survey	Geo-coordinates	Host plants
Ecopark, Kolkata	20 February,2021	22.6078°N, 88.4658°E	Coconut
Kultali	27 February,2021	21.9767°N, 88.5572°E	Wild date palm
Kultali	7 March, 2021	21.9767°N, 88.5572°E	Banana, coconut, wild date palm
Sagar	20 March, 2021	21.7836°N, 88.1283°E	Acacia, Coconut, wild date palm
Sagar	21 March, 2021	21.8619°N, 88.1294°E	Acacia, coconut, wild date palm



Firgure 1. **(A)** *Phoenix sylvestris* at Kultali, Sundarban Biosphere Reserve, West Bengal; **(B)** Puparium of *Aleurodius rugioperculatus* with emergence hole of parasitoid; **(C)** Early nymphal instars of *A. rugioperculatus*; **(D)** *Encarsia guadeloupae*; **(E)** Adults of *A. rugioperculatus*

rugioperculatus has never been reported (CABI, 2021) (https://www.cabi.org/isc/datasheet/122299). The present study documents for the first time *P. sylvestris* as a host of *A. rugioperculatus,* and also forms the first report of natural parasitization by *Encarsia guadeloupae* in West Bengal. The parasitoid species is a new record for West Bengal. *E. guadeloupae* has a blackish body with antennae, scapulae, scutellum, fore, middle and hind legs (except coxae and femora) yellowish (Viggiani, 1987).

Materials and Methods

Field surveys were carried out in three localities in West Bengal (Table 1), and the leaves of host trees infested with whitefly puparia were collected and reared in insect breeding dishes. The emerged parasitoids along with the emerged puparia were preserved in 90% ethyl alcohol. A few 4th instar puparia were directly preserved in 90% alcohol for species identification. Microphotographs of the puparia and the emerged parasitoids were taken using a Leica DFC 500 digital camera attached to Leica M205 A stereomicroscope (1X objective) and processed with LAS version 3.6 extended focus software. The voucher specimens of the whiteflies and the parasitoids are deposited in the National Zoological Collections at the Zoological Survey of India, Kolkata.

Results

The present study is based on the observations from five random field surveys undertaken in three localities in West Bengal. Parasitoids emerged only from the puparia on leaves of *P. sylvestris* (Figure 1A), collected on 27 February 2021 from Kultali, Sunderban Biosphere Reserve. A total of six parasitoids emerged (4 females and 2 males). Three parasitoids emerged on day four, two on day six and one on day nine from the date of rearing. Only one parasitoid emerged per puparium (Figure 1B). The parasitization rate was 40%. A second field survey in the same locality could not document any matured puparia or adult whiteflies on the host plant, but only early nymphal instars (Figure 1C). The parasitoids were morphologically identified as *E. gaudeloupae* (Figure1D). *E. guadeloupae* can be distinguished from *E. noyesi* by their dark-colored head (light in *E. noyesi*) and yellow scutellum (iridescent bluish-white in *E. guadeloupae*) (Taravati *et al.,* 2013). The whitefly species was confirmed to be the global invasive rugose spiralling whitefly, *A. rugioperculatus* (Figure 1E) and its infestation were less on wild date palms compared to other host plants like coconut and ornamental palms.

Discussion

CABI (2021) and Mondal *et al.* (2020) list the host plants of *A. rugioperculatus* from India. *Phoenix sylvestris* was not yet documented as the host of *A. rugioperculatus*, hence the present study forms the first report. According to an NBAIR report (https://www.nbair.res.in/node/833), whitefly attacks in West Bengal have been severe due to hot and humid weather, the availability of a diverse range of suitable plants and the lack of natural enemies. The survey report also states the absence of parasitoids in the region, only the predatory chrysopid, *Dichochrysa astour* (Neuroptera: Chrysopidae) was documented. There was no record of occurrence of *E. gaudelopae* from West Bengal (Noyes, 2019) and its natural parasitization by *E. guadeloupae* (Mondal *et al.,* 2020). The emergence of *E. guadeloupae* from the field collected *A. rugioperculatus* puparia documents natural parasitization by *E. gaudeloupae* in West Bengal, which could be a potential biocontrol agent for the pest.

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